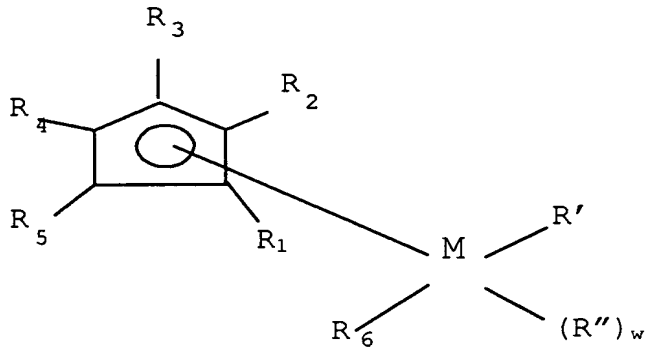
CLAIMS

1. A metallocene complex of a metal of group 4 of the periodic table having the following formula (I):



(I)

wherein:

- M is a metal selected from titanium, zirconium and hafnium, coordinatively bonded to a first η^5-cyclopentadienyl group;
- R' represents an unsaturated hydrocarbyl group;
- R" represents an optional group anionically bonded to the metal M, consisting of an organic or inorganic radical, different from cyclopentadienyl or substituted cyclopentadienyl;
- the groups R_1, R_2, R_3, R_4 and R_5, each independently represent, an atom or radical bonded to said first η^5- cyclopentadienyl group, and is selected from hydrogen or any other suitable organic or inorganic substituent of said cyclopentadienyl group;
- R_6 represents any other suitable organic or inorganic group, anionically bonded to the metal M;

- "w" has the value of 0 or 1, depending on whether the R" group is absent or present in formula (I);

characterized in that said R' group consists of an unsaturated oligomeric group having the following formula (II):

$$-(A_x D_y U_z) R^I \qquad (II)$$

wherein:

- A represents any monomeric unit deriving from a vinylaromatic group polymerizable by means of anionic polymerization, having from 6 to 20 carbon atoms;
- D represents any monomeric unit deriving from a conjugated diolefin polymerizable by means of anionic polymerization, having from 4 to 20 carbon atoms;
- U represents any generic optional monomeric unit deriving from an unsaturated compound copolymerizable with any of the above conjugated diolefins D or vinylaromatic compounds A;
- R^I represents hydrogen or a hydrocarbyl group having from 1 to 20 carbon atoms;
- each index "x" and "y" can be independently zero or an integer, provided the sum (x+y) is equal to or higher than 2;
- "z" can be zero or an integer ranging from 1 to 20;

with the proviso that, when R_6 is a η^5-

cyclopentadienyl or substituted η^5-cyclopentadienyl group and R' is $-(A_x)R^I$, R" is different from $-(A_x)R^I$.

2. The metallocene complex according to claim 1, wherein the metal M is selected from titanium and zirconium.

3. The metallocene complex according to any of the previous claims, wherein the metal M is titanium in oxidation state +3 and "w" in formula (I) is equal to 0.

4. The metallocene complex according to any of the previous claims 1 or 2, wherein M is zirconium in oxidation state +4 and "w" in formula (I) is 1.

5. The metallocene complex according to any of the previous claims, wherein said monomeric units of the D type in formula (II) derive from 1,3-diolefins having from 4 to 20 carbon atoms.

6. The metallocene complex according to claim 5, wherein said 1,3-diolefin is selected from 1,3-butadiene, isoprene, 1,3-pentadiene, 2-methyl-1,3-pentadiene, 1,3-hexadiene.

7. The metallocene complex according to any of the previous claims, wherein said monomeric units of the A type in formula (II) derive from vinylaromatic hydrocarbyl compounds having from 8 to 15 carbon atoms.

8. The metallocene complex according to claim 7, wherein said vinylaromatic compound is selected from styrene, α-methylstyrene, p-methylstyrene, vinylnaphthalene.

9. The metallocene complex according to any of the previous claims, wherein said sum (x+y) of the indexes in formula (II) is between 2 and 50.

10. The metallocene complex according to any of the previous claims, wherein the sum of the indexes (x+y+z) in formula (II) is between 2 and 15.

11. The metallocene complex according to any of the previous claims, wherein "z" in formula (II) is equal to 0.

12. The metallocene complex according to any of the previous claims from 1 to 9, wherein "x" and "z" in formula (II) are both equal to 0 and said group R' consists of an oligomer of a conjugated diene D with an average polymerization degree from 2 to 15.

13. The metallocene complex according to any of the previous claims, wherein said group R^I in formula (II) represents an aliphatic, cycloaliphatic, aromatic or alkyl aromatic group having from 2 to 10 carbon atoms, preferably selected from tert-butyl, n-butyl, isopropyl, n-hexyl, cyclohexyl, benzyl, phenyl and toluyl.

14. The metallocene complex according to any of the previous claims, wherein said group R" or said group R_6 are independently selected from hydrogen, halogen, an alkyl or alkyl aryl C_1-C_{20} group, an allyl C_3-C_{20} group, an alkyl silyl C_3-C_{20} group, a cycloalkyl C_5-C_{20} group, an aryl or aryl alkyl C_6-C_{20} group, an alkoxide

or thioalkoxide C_1-C_{20} group, a carboxylate or carbamate C_2-C_{20} group, a dialkyl amide C_2-C_{20} group and an alkyl silylamide C_4-C_{20} group.

15. The metallocene complex according to any of the previous claims 1 to 13, wherein both said groups R' and R" in formula (I) are independently oligomeric groups having formula (II), preferably essentially having the same formula.

16 The metallocene complex according to any of the previous claims, wherein said group R_6 is "bridge"-bonded to said first cyclopentadienyl group having formula (I) to form an overall cyclic structure including the metal M.

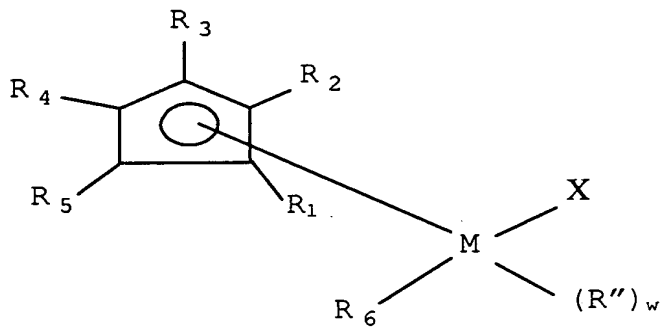
17. The metallocene complex according to any of the previous claims, wherein said group R_6 represents a second cyclopentadienyl group η^5-coordinated to the metal M.

18. The metallocene complex according to claim 17, wherein said first and second cyclopentadienyl group are equal to each orher.

19. The metallocene complex according to any of the previous claims 1 or 15, wherein said group R_6 represents a further oligomeric group having formula (II).

20. The metallocene complex according to any of the previous claims, also comprising one or more neutral coordinating compounds.

21. A process for the preparation of a metallocene complex according to any of the previous claims, comprising the contact and reaction, in suitable proportions, of a metallocene precursor having the following formula (IV):



(IV)

wherein: the symbols M, R", R_1, R_2, R_3, R_4, R_5, R_6, and "w" can have any of the meanings for the corresponding symbols in formula (I), according to any of the previous claims, and

X represents a suitable outgoing anionic group in a nucleophilic substitution reaction on the metal M;

with an organometallic compound having the following formula (V):

$$M'T_t[(A_x\ D_y\ U_z)R^I] \qquad (V)$$

wherein:

the symbols A, D, U, R^I, "x", "y" and "z" can have any of the meanings mentioned for the corresponding symbols in formula (II) of claim 1,

M' is a metal selected from metals of groups 1 or 2 of the periodic table of elements,

T is any suitable organic or inorganic anion, or another group having the formula $(A_x D_y U_z)R^I$,

"t" has the value of 0 when M' is a metal of group 1, and the value of 1 when M' is a metal of group 2 of the periodic table,

until the desired compound having formula (I) is obtained.

22. The process according to claim 21, carried out in the presence of a suitable inert solvent, preferably hydrocarbon, and at a temperature ranging from -60 to +100 °C.

23. The process according to claim 22, carried out at a temperature ranging from -20 to +40 °C, for a period of 5 minutes to two hours.

24. The process according to claim 22 or 23, wherein said solvent is selected from cyclohexane, hexane, heptane, toluene and ethyl benzene.

25. The process according to any of the claims from 21 to 24, wherein said organometallic compound having formula (V) is added to the precursor having formula (IV) in an inert solvent.

26. The process according to any of the claims from 21 to 25, wherein said organometallic compound having for-

mula (V) is obtained by means of a living anionic polymerization reaction.

27. The process according to claim 26, wherein said organometallic compound having formula (V) is directly used as obtained in the preparation solution.

28. The process according to any of the claims from 21 to 27, wherein said precursor having formula (IV) and said organometallic compound having formula (V) are put in contact with each other with atomic ratios M'/M close to the stoichiometric value and up to a molar excess of 15% of M' with respect to M.

29. The process according to any of the claims from 21 to 28, wherein in said precursor having formula (IV), said outgoing group X is selected from a chloride or bromide group, an alkyl silyl C_3-C_{20} group, an alkoxide or thioalkoxide C_1-C_{20} group, a carboxylate or carbamate C_2-C_{20} group, a dialkyl amide C_2-C_{20} group and a alkyl silylamide C_4-C_{20} group.

30. The process according to claim 29, wherein said X group in formula (IV) is chloride or bromide.

31. The process according to any of the claims from 21 to 30, wherein the symbols X and R" in said precursor having formula (IV) both represent a suitable outgoing anionic group, preferably chloride.

32. The process according to any of the claims from 21 to

30, wherein the symbols X, R" and R_6 in said precursor having formula (IV) all independently represent a suitable outgoing anionic group, preferably chloride.

33. The process according to any of the claims from 21 to 32, wherein said metal M' in the compound having formula (V) is selected from lithium, sodium or magnesium, preferably lithium.

34. Metallocene complex according to claim 1, wherein at least one of said groups R', R" e R_6 includes an olefinically unsaturated double bond.

35. Use of the metallocene complex according to any of the claims from 1 to 20 and 34, for the preparation of a catalytic composition for polymerization of hydrogenation processes.

36. Use according to claim 35 for polymerization processes.